

REMARKS

Summary of the Office Action

In the Office Action, the Office:

- Objected to the Specification as failing to provide antecedent basis for the claimed subject matter;
- Rejected Claims 12-14 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement;
- Rejected Claims 4, 7, 11, 14, and 21 under 35 U.S.C. § 112, second paragraph, as being indefinite;
- Rejected Claims 1, 2, 4, 8, 9, 11, 15-17, 22, 24, and 25 under 35 U.S.C. § 103(a) as being unpatentable over Harris (WO 02/060653) in view of Akin (U.S. Patent No. 4,565,104);
- Rejected Claims 3 and 10 under 35 U.S.C. § 103(a) as being unpatentable over Harris (WO 02/060653) in view of Akin (U.S. Patent No. 4,565,104) and in further view of Yamanaka (U.S. Patent No. 4,825,714);
- Rejected Claims 5-7, 12-14, and 23 under 35 U.S.C. § 103(a) as being unpatentable over Harris (WO 02/060653) in view of Akin (U.S. Patent No. 4,565,104) and in further view of Zufle (U.S. Patent Application Publication No. 2003/0109953);
- Rejected Claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Harris (WO 02/060653) in view of Akin (U.S. Patent No. 4,565,104) and in further view of Zimmerman (U.S. Patent No. 6,494,005); and
- Rejected Claim 10 under 35 U.S.C. § 103(a) as being unpatentable over Harris (WO 02/060653) in view of Akin (U.S. Patent No. 4,565,104) and in further view of Zimmerman (U.S. Patent No. 6,494,005) and in further view of Zufle (U.S. Patent Application Publication No. 2003/0109953).

Claims 1-25 are currently pending in this Application. By this Reply, Applicant has amended Claims 1, 5 and 7, and cancelled Claims 2, 4, 11-14 and 19-23. Applicant respectfully

submits no new matter was added by these amendments and that such amendments are fully supported by the Application as originally filed. Accordingly, Claims 1, 3, 5-10, 15-18 and 24-25 are at issue.

The Office has objected to the specification for failing to provide proper antecedent basis for the claimed subject matter. Applicant respectfully traverses this objection.

Rejections under 35 U.S.C. § 112, first paragraph

The Office has rejected claims 12-14 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. Applicant has cancelled Claims 12-14 as set forth above. Accordingly, Applicant respectfully submits this rejection is now moot.

Rejections under 35 U.S.C. § 112, second paragraph

The Office has rejected claims 4, 7, 11, 14 and 21 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Applicant has cancelled Claims 4, 11, 14 and 21 as set forth above. Accordingly, Applicant respectfully submits the rejection to Claims 4, 11, 14 and 21 is now moot. Applicant traverses the rejection to Claim 7.

Applicant respectfully submits that Claim 7 does not include the term “high” which was alleged to run afoul of 35 U.S.C. § 112, second paragraph. Claim 7 depends directly from Claim 5 which depends directly from Claim 1. The term “high” does not appear in either of Claims 1 or 5. Therefore, Applicant submits that Claim 7 should not have been rejected under 35 U.S.C. § 112, second paragraph.

Rejections Based on Prior Art

The Office has rejected claims 1, 2, 4, 8, 9, 11, 15-17, 22, 24 and 25 under 35 U.S.C. § 103(a) as being unpatentable over Harris, in view of Akin. Claim 1 has been amended.

Claim 1, as amended, is directed to a back-drivable *surgical* robot. To further clarify Claim 1, the claim now explicitly recites a frame with the first lead screw and rotational motor being mounted *at one end of the lead screw* to pivot with respect to the frame. It is further specified that when the bearing is at one end of the lead screw (e.g., as shown in FIG. 4) the screw takes up a zero pivotal position. As a force is applied to the manually graspable driving member, the bearing moves along the lead screw, and the lead screw pivots away from the zero

position to a maximal position at which the bearing is part way along the screw (e.g., as shown in FIG. 3). As the movement continues, the lead screw returns to the zero position, reaching it at an extreme position (e.g., as shown in FIG. 5) when the bearing reaches an opposite end of the lead screw.

In the Office Action, the Office rejected Claim 1 as unpatentable over Harris in view of Akin. While not conceding that the previous rejection is valid, Applicant has amended Claim 1 to recite in much more detail the novel and non-obvious differences between the present invention and the disclosures of Harris and Akin.

Specifically, it is now explicitly stated that the invention relates to a back-drivable surgical robot head, the field of surgical robot heads being entirely non-analogous to the field of Akin. As set forth in reply to the previous Office Action, Akin is specifically concerned with the problem of handling large loads, such as earth station antennas, which have to be driven through rotation angles of 180° or more while maintaining a substantial moment arm at the extremities of travel (see Akin at col. 1, line 67; at col. 3, lines 65-68, and at col. 5, lines 32-41). Not only are these requirements completely different from those which are required of surgical robots, but Akin does not relate to the field of robotics at all, whether surgical or otherwise.

Not every mechanical device can be described as a robot, nor does the fact that a mechanical system moves a load make it relevant to the field of robotics, let alone to the very specialized field of surgical robotics. Akin is in a completely different field of endeavor.

The particular problem that the present invention is concerned with relates to a means of making a surgical robot head back-drivable. In section 15 of the Office Action, the Office argues that the device of Akin is attached to a motor "which can be run forwards and reverse thus making the system back drivable." The Office's argument fails to appreciate that the concept of back-drivability has a specific meaning which is quite different than that argued by the Office.

Attached to this Reply is a copy of a paper found on the internet by means of a simple Google search for "back-drivability." As the paper clearly indicates, back-drivability concerns the ability of a mechanical system to move the input axis from the output axis. In the present invention, it concerns the ability of the user (e.g., a surgeon) to apply an external force to the

manually graspable driving member, and for the force to be transmitted back along the gear chain to the input motor.

To make the issue of back-drivability clearer, Claim 1, as amended, specifies that it is a force applied to the driving member which causes the lead screw to rotate (and depending upon the direction of the applied force, this may be in a direction opposite from that which the motor is urging).

Back-drivability is generally of no interest to engineers working on simple mechanical systems, such as that of Akin, because in such systems, positional control is always achieved by suitable movements of the input motor, running either in forward or in reverse. There would be absolutely no need for Akin to consider back-drivability (in that case, the ability to move the mounted antenna in a direction opposite to the one on which it is being driven by the motor, merely by applying brute force to the antenna itself). Even if one were to apply physical force to the antenna, back-drivability would still not result. Instead, the countervailing large forces being applied by the motor and externally to the antenna would still, in all probability, simply damage the equipment.

Even in the unlikely event that one of ordinary skill in the art of surgical robotics were to look into the entirely different technical field of controlling rotational motion of large loads, the present invention would still not result.

Akin is concerned with the problem of rotating a load through an angle of 180° or more, and at column 2, lines 13-16, Akin emphasizes how the mechanical arrangement described can in some circumstances produce a rotational angle "*well beyond 180°*."

This is the opposite of the particular problem of concern to the Applicant. In surgical robotics, it is important to maintain a small a swing as possible, because a large swing such as that used in Akin would necessarily require a large case. It will be appreciated, of course, that in a surgical setting, the internal mechanisms of the robot cannot normally remain exposed. A large case not only interferes with the surgeon's movements, but also makes it much more difficult to comply with the very strict limits on EM transmissions that apply to medical devices such as this.

In Section 14 of the Office Action, the Office analyzes the statement in Harris at p. 8, lines 22-26. Applicant concurs, of course, that the test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art, but subject to the prior art references being either in the applicant's field of endeavor or, if not, to be reasonably pertinent to the particular problem which the applicant was concerned. Neither is the case here.

Furthermore, earlier in that section, the Office argued that Harris neither mentions nor suggests that the device of Akin *cannot* be incorporated into Harris. With all due respect, such is not the test of obviousness, and if such were the case, it would represent an intolerable burden on patent applicants if they were required to point to a specific statement in one prior art reference to the effect that a different drive system from another field of endeavor would definitely not be usable. In fact, Harris' silence in that regard is evidence of such replacement not being contemplated by one of ordinary skill in the art and thus non-obvious.

Conclusion

As a result of the above Amendments and Remarks, Applicant respectfully submits that the Application is in condition for allowance. If any deficiencies remain, the Office is invited to telephone the undersigned to facilitate allowance of the claims.

Respectfully submitted,

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